

there is little or no danger to the operator through faulty switch-gear.

The switch-board proper is carried by three galleries extending the whole length of the north side of the engine-room and continued along the east end. The control board is on the middle gallery and projects slightly, so that the operator has a clear view up and down the engine-room. From the switch-board the energy is distributed to the various substations situated at various points along the system, and it is there converted to low-voltage direct current at 550 volts, and thence distributed to the live rail. Throughout the whole station it is remarkable to

38 grains of Anthony's pure snowy cotton in $2\frac{1}{4}$ ounces of pure amyl acetate, precipitating the resultant collodion in a large tray of pure water—constantly agitating the mixture—thoroughly drying the precipitate, and then re-dissolving it in the same quantity of pure amyl acetate. The collodion thus obtained is carefully filtered, and is then ready for use.

The grating to be copied is levelled in a roomy drying cabinet, which, in order to preclude dust particles, should be as free from draughts as possible, the surface dusted with a soft camel-hair brush, and the collodion flowed over it evenly. The author uses about twenty-five drops

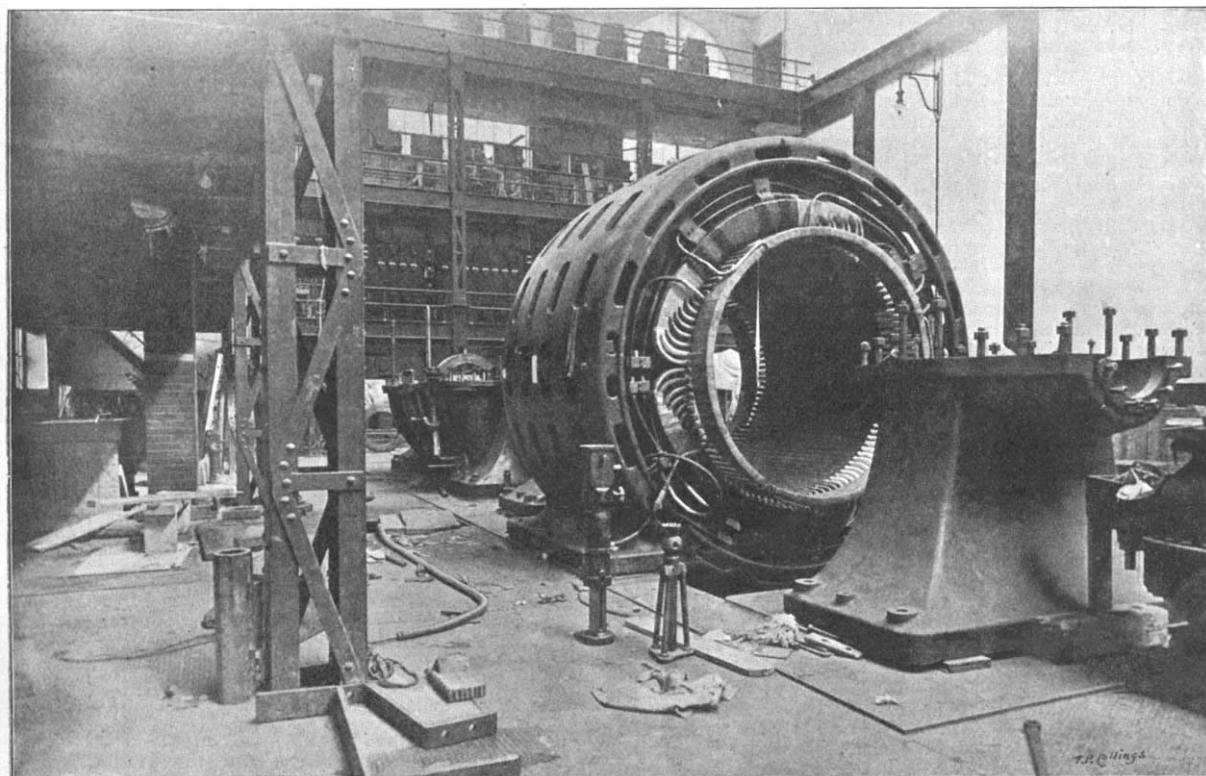


FIG. 1.—Armature of 5500 K.W. Generator.

find the extent to which labour-saving devices are employed.

Thanks are due to Mr. Chapman, general manager and chief engineer, for permission to view the station, and to the Institution of Electrical Engineers for the accompanying illustration of the armature of one of the generators.

REPLICAS OF DIFFRACTION GRATINGS.

FROM an article in No. 2, vol. xxii., of the *Astro-physical Journal*, we learn that Mr. R. J. Wallace, of the Yerkes Observatory, has attained great perfection in the production of replicas from plane diffraction gratings. After some amount of previous research, he decided on following Thorp's method in its essentials with several modifications which his experience suggested. Mr. Thorp first hooded his original grating with high-grade oil before pouring on the celluloid solution on which the replica was made. Mr. Wallace found it better to omit the oil. In the original method a solution of gun-cotton in amyl acetate with camphor added was employed as the material for the replica, but Mr. Wallace found that he could obtain much clearer and brighter copies by not adding the camphor. His successful solution is made by dissolving

of the solution in copying a 2-inch grating. The grating is then replaced on the levelled support and left to dry for about eight to twelve hours; the longer the drying period the better is the resulting copy. After being thoroughly dried the grating is placed in pure distilled water at normal temperature together with the glass ("white optical crown") support, which has previously been evenly coated with the adhesive medium, plain hard gelatin. After a few minutes' soaking the edge of the film may be sprung from the grating, and the whole of it is then detached and immediately placed on the previously prepared gelatin surface and clamped there. Perfect contact is obtained by drawing a piece of the softest velvet rubber *very lightly* over the surface in the direction of the length of the lines.

The contraction suffered by the replica during the twenty-four hours' drying period slightly alters the number of lines per inch, but the effect is very small. In some of Mr. Wallace's copies this alteration produced 572 lines per mm. instead of the 568 lines that occupied the same space on the original. Two reproductions of the solar spectrum, one taken with the original grating, the other with the copy, show the resulting increase of dispersion caused by the contraction, and also show that everything which is resolved by the original grating is also resolved equally well under the same conditions by the copy.

The grating replicas, unmounted, transmit the more refrangible radiations up to λ 2613, practically without absorption, but the glass used as supports for the copies is opaque beyond λ 3400, therefore Prof. Wood has proposed that mica should be employed for the supports where "ultra-violet" work is to be prosecuted. Reproductions of some spectrograms obtained with and without the mica screens show the value of Prof. Wood's suggestion.

Mr. Wallace recommends the "copying" process as the most efficient method of cleaning a dirty grating, and he has also tried it for the production of replicas of concave gratings, but as yet without any notable success.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Mr. T. S. Moore has been elected to a fellowship at Magdalen College after an examination in chemistry. Mr. Moore was educated at the East London Technical College; he gained a postmastership in natural science at Merton in 1898, was placed in the first class in mathematical moderations in 1900, and in the natural science school in 1902. He was lately appointed lecturer in chemistry in the University of Birmingham.

St. John's College recently procured an important change in its statutes which will be of great assistance in the new forestry scheme. The college was bound by the statutes of 1877 to endow a chair of mechanics and civil engineering so soon as its revenue permitted; by the new statute this obligation is removed, and instead St. John's is to contribute in and after 1908 600*l.* a year to the Sibthorpe professorship of rural economy. It is understood that the main subject to be entrusted to the future professor is pathological botany, so that he will have an important share in the instruction of the forestry students. St. John's has also placed a considerable plot of land near Bagley Wood at the disposal of Prof. Schlich for the purpose of starting a "forest garden."

At the first meeting of the delegacy which is to superintend the instruction of the Indian forestry students Prof. Schlich was appointed secretary, and Mr. D. H. Nagel (Trinity College) assistant secretary.

Prof. Osler and Prof. Miers were among the new members of the hebdomadal council who were elected on October 26.

The examinations for natural science scholarships this term will take place at the following dates:—December 5, Balliol, Christ Church, and Trinity; December 12, University, Lincoln, and Magdalen; December 19, Jesus College.

CAMBRIDGE.—A memorial has been presented to the council of the senate requesting the council to take steps by the nomination of a special syndicate or otherwise to ensure the consideration of the following questions:—(1) the advisability of imposing on all such candidates, as may not otherwise be qualified for exemption, the passing of the previous examination or of another examination, in lieu of the previous examination, as a condition precedent to matriculation in the university; (2) the possibility of obtaining the cooperation of the University of Oxford with the University of Cambridge in establishing a joint examination which should qualify for matriculation in either university. This memorial has been signed by some seventy influential members of the university. It has been referred by the council of the senate to the studies and examinations syndicate.

The electors to the Allen scholarship give notice that they are prepared to receive applications from candidates. Any graduate of the university is eligible for the scholarship provided that his age on the first day of the Lent Term 1906 does not exceed twenty-eight years. Next year the scholarship is open to candidates who propose to undertake research in medicine, mathematics, physics and chemistry, biology and geology, moral science. The scholarship is tenable for one year, during which period it will be the duty of the student to devote himself to research in Cambridge or elsewhere. The emolument of the student is 250*l.*, or such smaller sum as the fund, after

payment of all expenses, shall be capable of providing. Every candidate must send to the Vice-Chancellor, Trinity Hall Lodge, on or before February 1, 1906, his name and a definite statement of the course of research which he proposes to undertake, together with such evidence of his qualifications as he thinks proper, and with the names of not more than three referees to whom the electors may apply for information. The election will be made towards the end of the Lent term, 1906.

In its report upon its reserve fund, the museums and lecture rooms syndicate enumerate a number of varying sums spent upon the museums. It has granted 100*l.* toward the expenses of housing Prof. Bonney's collections in the Sedgwick Museum, and has also allotted some smaller sums to the furnishing of the rooms in the new medical schools. It is a pity there are not sufficient funds at the disposal of the syndicate to fit up the Humphry Memorial Museum, the bare walls of which cry for shelves and showcases.

THE annual general meeting of the Association of Teachers in Technical Institutes will be held at the Birkbeck College on Saturday, November 4, at 3 p.m., with Mr. W. J. Lineham, chairman of the association, in the chair.

A COURSE of eight lectures on fields of force will be given in Columbia University, New York City, by Prof. V. F. K. Bjerknes, professor of mechanics and mathematical physics in the University of Stockholm, on Fridays and Saturdays in December. The lectures will be open, without charge, to teachers and advanced students in physics. During March and April, 1906, a course of lectures will be given by Prof. H. A. Lorentz, professor of physics in the University of Leyden.

THE Berlin correspondent of the *Times* states that in the presence of the German Emperor, the American Ambassador, the German Foreign Secretary, the Prussian Minister of Education, and other men of distinguished eminence, an inaugural lecture was delivered in English by Prof. Peabody, of Harvard University, in the central hall of Berlin University on Monday, October 30. Prof. Peabody discussed the advantages of the scheme put forward by the German Emperor for the exchange of lecturers between German and American universities, and read a letter which he had received from President Roosevelt approving of the scheme.

WE have received an advance copy of the report of the work of the department of technology of the City and Guilds of London Institute for the session 1904-5. The report refers to some of the ways by which the institute is able to cooperate with the central educational authorities for Great Britain and Ireland, in assisting and guiding schools in their arrangements for the provision of technological instruction, and in effecting a proper coordination between workshop and class teaching. The department of technology suggests schemes for complete courses of evening instruction for artisans and others engaged in different industries, and prepares detailed syllabuses in the technology of each trade subject. The institute registers classes in any of the subjects contained in its programme, provided the conditions preliminary to registration are fulfilled. During the past session 2601 classes were registered in 364 towns. These were attended by 41,618 students, being 671 more than in the previous session. Before registering a class, the institute requires that the qualifications of the teacher shall be submitted to, and approved by, the department of technology. During the session under review, 195 new names have been added to the institute's register of teachers in technology, and 149 have been provisionally approved. The institute has inaugurated a system of inspection of trade classes by professional experts. During the past session 149 classes were inspected by members of the institute's staff. The report also contains full statistics relating to affiliated technological classes, and instructive extracts from some of the examiners' reports on the results of the examinations, 1905.